

American Museum Novitates

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CENTRAL PARK WEST AT 79TH STREET, NEW YORK, N. Y. 10024

NUMBER 2371

MAY 12, 1969

Results of the 1958–1959 Gilliard New Britain Expedition 5. A New Species of *Pteropus* (Mammalia, Pteropodidae) from New Britain, Bismarck Archipelago

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INTRODUCTION

During the 1958–1959 Gilliard New Britain Expedition, Patrol Officer David Moorhouse and E. Thomas Gilliard cut a trail into the rugged karst country near the center of the Whiteman Range. This range lies midway between the north and south coasts on the western arm of the island of New Britain in the Bismarck Archipelago. Camp 12, their “summit camp,” was pitched on a forested limestone spur (which they named Wild Dog Ridge) at an elevation of about 5200 feet (1600 meters). This camp (fig. 1) was occupied by Gilliard from December 13 to 23, 1958; Margaret Gilliard arrived in camp on December 20.

Using a technique for catching bats and birds long employed by some mountain natives in New Guinea, the Gilliards rigged a net parallel to the ridge top in a “slot,” or “window,” of cleared vegetation on the night of December 20. The next morning four individuals of *Megachiroptera* were entangled in the mist net: two of *Melonycteris melanops*, one individual

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of *Syconycteris*, and a small, dark-colored, heavily furred individual of the genus *Pteropus*.

Three species of *Pteropus* are known from New Britain: *P. neohibernicus neohibernicus*, *P. temmincki capistratus*, and *P. hypomelanus luteus*. Specimens of these three species are in Margaret Gilliard's collection from New Britain. *Pteropus n. neohibernicus* is the largest fruit bat on the island; the forearm of adults measures at a minimum 175 mm., and the conspicuous colored hair of the mantle (nape of neck and shoulder region) is reddish yellow. The face of *P. temmincki capistratus* has striking whitish patches bordered by blackish brown markings; the forearm averages about 120 mm. *Pteropus hypomelanus luteus* has a distinct mantle like that of *P. n. neohibernicus*, but it is a much smaller bat, the forearm averaging about 130 mm.

Unlike *P. n. neohibernicus* and *P. hypomelanus luteus*, the new specimen of *Pteropus* does not have a distinct yellowish mantle, the forearm measures 114 mm., and the premolar and molar dentition is weak compared with that of the known species of *Pteropus* on New Britain. Its nearest relatives seem to be *Pteropus mahaganus* and *Pteropus woodfordi* of the Solomon Islands, and *Pteropus scapulatus* of Australia. These species, however, are quite distinct from the species represented by the new specimen. Detailed comparisons follow the description of this new species.

METHODS

Several external measurements in millimeters were made in the field by the collector: total length, hind foot (with claw), ear (from crown), and wingspread. All other external measurements were made on the dried study skin in the American Museum. Cranial measurements follow those of Handley (1959). For purposes of comparison, certain additional cranial measurements used by Andersen (1912) have also been taken. Measurements taken in the American Museum were made in millimeters with dial calipers and with the aid of a binocular microscope.

For many years mammalogists have used Ridgway (1912) as the basis for color descriptions. In the present paper I have used both Ridgway and Villalobos-Domínguez and Villalobos (1947). The Ridgway colors are capitalized; the equivalent Villalobos color codes are in parentheses after each of the Ridgway colors. One example will explain the method used. To determine the color of the stiff hairs surrounding the glands on each side of the neck I first used Ridgway; the color was nearest to Sudan Brown in my opinion. In the Villalobos-Domínguez and Villalobos plates (*op. cit.*), I found a number of color codings on plate 0 (basic hue, orange) which appeared close to the color of the neck-gland



FIG. 1. Camp 12 on Wild Dog Ridge in the Whiteman Range of New Britain. E. Thomas Gilliard is at far side of table. The study skin of *Pteropus gilliardi* is the large bat pinned on the drying board in the foreground. Photograph by Margaret Gilliard; courtesy of the National Geographic Society.

hairs. This multiple choice of colors on the plate of orange hue (based on various degrees of color intensity and color saturation) permitted me to choose a color more quickly and with a greater degree of confidence than by using Ridgway. The actual color code decided upon was not the exact equivalent (as given in the appendix of Villalobos-Domínguez and Villalobos), but it was well within the tolerance limits of the Ridgway color. In the relatively few color descriptions used in the present study, the correspondence of Ridgway and Villalobos color equivalents was good. As Davis (1956) has pointed out in his interesting review of Villalobos-Domínguez and Villalobos (1947), the actual physical job of comparing each color square with the particular area of pelage on the specimen is made more convenient by a circular perforation in each square; the hue plates are also removable from the "Atlas." The copy of Villalobos-Domínguez and Villalobos that I used bears the following statement, ". . . the authors' stamp guarantees that the plates of this numbered copy have been verified as identical to those of any other copy equally guaranteed. No. 0013."

ACKNOWLEDGMENTS

Archbold Expeditions owes a debt of gratitude to the abilities of Margaret Gilliard who assembled the largest and most important collection of mammals ever made on the island of New Britain. The collecting, as well as the preparation, of specimens was accomplished during an arduous overland trip to the Whiteman Range despite her other duties which often included the running of a base camp, the supplying of advance camps, and assistance to her husband in the study and collection of birds. The late Dr. Gilliard enthusiastically encouraged her in collecting mammals on an expedition in which the study of the avifauna was of paramount importance. This new species of *Pteropus* is named in their honor.

I wish to thank Dr. Joseph Curtis Moore who lent me comparative material from the Field Museum of Natural History. I am grateful to Mr. Juan C. Barberis of the Department of Exhibition and Graphic Arts for his excellent drawings of the skull. Mr. Herbert S. Wilburn, Jr., Illustrations Editor of *The National Geographic Magazine*, very kindly supplied the black-and-white conversion print showing Gilliard's "summit camp" in the Whiteman Range.

To my friend, Dr. Karl F. Koopman, Associate Curator of the Department of Mammalogy, the American Museum of Natural History, I extend my deep appreciation for his interest and objective counsel during the preparation of this paper. No person is better equipped to discuss

problems relating to the Chiroptera, and no one is more gracious.

ABBREVIATIONS

A.M.N.H., the American Museum of Natural History

F.M.N.H., Field Museum of Natural History, Chicago, Illinois

DESCRIPTION

Pteropus gilliardi, new species

HOLOTYPE: A.M.N.H. No. 194292 (Archbold Collections), field number MG34, young adult male, study skin with skull in good condition; collected by Margaret Gilliard at Camp 12 ("summit camp"), Wild Dog Ridge, Whiteman Mountains, New Britain; elevation about 5200 feet (1600 meters); December 21, 1958.

PARATYPES: None.

RANGE: Known only from the type locality on New Britain in the Bismarck Archipelago, but probably occurs throughout the mountain forests of New Britain and possibly on New Ireland.

DIAGNOSIS: A small (forearm, 114; condylobasal length of skull, 46.5), dark, heavily furred species of *Pteropus* with weakly developed cheek teeth. Ears broad, with rounded tips. Intermediate in size between the smaller *P. woodfordi* and the larger *P. mahaganus* and *P. scapulatus*, all of which have weak dentitions.

MEASUREMENTS: External measurements of the type are: head and body, 154; hind foot (with claw), 40; ear (measured from the crown), 20; ear (measured dry, from the notch), 20.7; wingspread, "approximately 820"; forearm (measured dry), 114. Cranial measurements of the type are: greatest length of skull, 48.5; condylobasal length, 46.5; zygomatic width, 27.2; least interorbital width, 8.4; mandibular length, 33.6; coronoid height, 15.6; length of maxillary tooth row (c-m²), 15.8; length of mandibular tooth row (c-m₃), 18.1. See table 1 for additional cranial and dental measurements.

COLOR AND PELAGE: The color of the type is near Olive-Brown (0 6-3°) in general coloration. The mantle hairs are between Dresden Brown (0 8-5°) and Olive-Brown (0 6-3°), a warmer tone than that of the back and rump hairs which are near Mummy Brown (0 3-8°). The ventral hairs are near Saccardo's Slate (0 8-3°); this color is close to that of the mantle. The stiff hairs surrounding the glands on each side of the neck are near Sudan Brown (0 8-12°). Throughout the pelage there are long black guard hairs up to 21 mm. in length; there are concentrations of these hairs in the throat region and in the center of the back. The color of the distal one-fifth of many of the mantle hairs and up to one-half of

TABLE 1
MEASUREMENTS (IN MILLIMETERS) OF FOUR SPECIES OF *Pteropus*

	<i>P. gilliardi</i>		<i>P. woodfordi</i>		<i>P. scapulatus</i>		<i>P. mahaganus^a</i>	
	A.M.N.H.	F.M.N.H.	F.M.N.H.	F.M.N.H.	A.M.N.H.	A.M.N.H.	A.M.N.H.	F.M.N.H.
	No. 194292	No. 31568	No. 31569	No. 31570	No. 154582	No. 154576	No. 154563	No. 31563
	Male	Male	Male	Male	Male	Male	Male	Male
Head and body, length	154	149	160	145	227	194	215	223 (201-223)
Forearm, length measured in field	—	102	98	—	142	133	140	—
Forearm, length measured on dry skin	114	97	96	—	140	131	139	143.6 (131.8-143.6)
Hind foot, length with claw	40	33	31	32	43 ^b	40 ^b	40 ^c	46 (43-48)
Ear, length	20	19	20	16	30	27	30	23 (23-25)
Skull, greatest length	48.5	44.6	43.9	(42.5) ^c	57.6	53.4	55.7	59.9 (54.6-59.9)
Condylobasal length	46.5	42.6	41.9	(40.0) ^c	56.9	51.3	54.0	58.7 (52.6-58.7)
Palation to incisive foramina, length	21.5	19.2	18.3	—	26.8	24.1	25.7	28.3 (25.0-28.3)
Front of orbit to tip of nasals, length	15.5	13.7	13.0	12.3	18.5	17.2	17.7	20.4 (18.0-20.4)
Braincase at zygomata, width	21.4	18.0	18.4	—	23.0	(21.6) ^c	22.2	22.5 (21.7-22.5)
Zygomatic width	27.2	26.6	28.0	—	34.7	30.2	31.5	35.4 (29.0-35.4)

TABLE 1—(Continued)

	<i>P. gilliardi</i>		<i>P. woodfordi</i>		<i>P. scapulatus</i>		<i>P. mahaganus</i> ^a	
	A.M.N.H. No. 194292	F.M.N.H. No. 31568	F.M.N.H. No. 31569	F.M.N.H. No. 31570	A.M.N.H. No. 154582	A.M.N.H. No. 154576	A.M.N.H. No. 154563	F.M.N.H. No. 31563
	Male	Male	Male	Male	Male	Male	Male	Male
Width across m ¹ -1 externally	13.0	11.2	—	10.7	13.5	—	13.8	14.9 (13.7-15.0)
Width across c ¹ -1 externally	11.4	9.9	—	9.5	13.3	12.1	13.2	13.5 (11.5-13.5)
Postorbital width	11.5	7.5	7.7	—	9.9	9.4	9.8	8.2 (8.2-11.0)
Interorbital width	8.4	6.7	7.4	6.9	9.9	8.0	8.5	9.0 (7.2-9.0)
Orbital diameter	11.1	9.1	9.3	9.2	12.5	11.8	11.8	12.6 (11.9-12.6)
Mandible, length	33.0	30.7	29.8	(28.6) ^c	39.8	37.0	38.3	43.9 (40.9-43.9)
Coronoid height	15.6	14.0	15.2	14.0	18.0	16.0	17.7	20.5 (16.2-20.5)
c-m ² , crown length	15.8	14.6	—	14.1	19.1	16.7	18.4	19.5 (17.9-19.5)
c-m ₃ crown length	18.1	16.4	15.6	15.8	22.5	18.3	20.8	22.6 (19.0-22.6)
Upper incisors, combined width	5.3	4.3	—	—	6.7	5.7	6.2	6.5 (4.6-6.5)
p ⁴ , length	2.7	2.0	2.1	2.1	2.5	2.6	2.8	—
p ⁴ , width	1.7	1.4	1.5	1.4	1.9	1.8	1.9	—
m ¹ , length	3.0	2.5	2.5	2.5	2.6	2.6	2.8	—
m ¹ , width	1.8	1.5	1.5	1.5	1.8	1.6	1.8	—
m ² , length	1.8	1.2	—	1.3	1.3	0.8	1.4	2.0 (1.7-2.0)
m ² , width	1.3	1.0	—	1.0	1.0	0.8	1.1	1.7 (1.3-1.7)
p ₄ , length	2.7	2.1	2.4	2.2	2.9	2.6	3.0	—

TABLE 1—(Continued)

	<i>P. gilliardi</i>		<i>P. woodfordi</i>		<i>P. scapulatus</i>		<i>P. mahaganus</i> ^a	
	A.M.N.H. No. 194292	F.M.N.H. No. 31568	F.M.N.H. No. 31569	F.M.N.H. No. 31570	A.M.N.H. No. 154582	A.M.N.H. No. 154576	A.M.N.H. No. 154563	F.M.N.H. No. 31563
	Male	Male	Male	Male	Male	Male	Male	Male
p ₄ , width	1.6	1.3	1.3	1.3	1.9	1.6	1.6	—
m ₁ , length	2.8	2.1	2.4	2.3	2.7	2.3	2.7	—
m ₁ , width	1.5	1.3	1.4	1.3	1.6	1.5	1.7	—
m ₂ , length	2.0	1.6	1.7	1.7	1.8	1.4	2.0	—
m ₂ , width	1.5	1.3	1.4	1.3	1.3	1.1	1.4	—
m ₃ , length	1.3	1.0	1.1	1.0	0.9	— ^d	0.8	1.4 (1.2–1.4)
m ₃ , width	1.0	0.9	0.9	0.8	0.8	— ^d	0.7	1.2 (1.1–1.2)

^aThese measurements (all from Sanborn, 1931) are those of the type, a male, followed in parentheses by the minimum and maximum measurements of four males, including the type, and one female.

^bAll measurements of the hind foot include the longest claw. Tate's labels for the 1948 Cape York (Australia) Expedition were all printed "s.u." (without claw), but all the specimens actually were measured "with claw."

^cF.M.N.H. No. 31570 and A.M.N.H. No. 154576 have partially broken skulls. Measurements in parentheses indicate best possible measurement.

^dIn A.M.N.H. No. 154576 m₃ is not present in either ramus of the mandible; the alveoli are also absent. Of 27 *P. scapulatus* specimens examined in the Archbold Collections, both right and left m₃ are absent from eight specimens; the alveoli are also absent. In another specimen m₃ is present in the left ramus but absent, as is the alveolus, from the right ramus. Six of these nine specimens are females. (See Andersen, 1912.)

some of the ventral hairs is Straw Yellow (YY0 18-8°).

In subjective terms the general coloration is a faded yellowish brown, the rump being a clearer brown and the mantle and venter warmer in color owing to the tipping of many of the hairs with pale yellow. The cheeks and top of the head are grayish black; many of these hairs are either tipped with silver-gray or are entirely gray. The hairs of a small patch in the middorsal area of the back just posterior to the mantle are also tipped with gray or are entirely gray. The rostrum is covered with very short, black, brown, and silvery hairs, which give a bare and somewhat brownish cast to the muzzle. The ventral surface of the wing membrane near the forearm is covered with short, golden-yellow hairs. The hairs of the neck glands stand out sharply in contrast to the hairs surrounding them because of their deeper yellowish brown coloration. The over-all color impression is of drabness.

With the exception of the heavier black guard hairs and some of the hairs on the flanks, the hairs are crinkly. This character gives the pelage a woolly appearance and texture. The mantle and throat hairs are about 15 mm. in length; those of the rump and venter, about 10; head, 4; and muzzle, 2. The tibia is naked above (*sensu* Andersen, 1912).

COMPARISONS WITH SIMILAR SPECIES

I consider *Pteropus gilliardi* as the fourth known member of what Andersen (1912) designated the "*Pteropus scapulatus* group," the other three species being *P. mahaganus* from Ysabel (Mahaga Island) and Bougainville in the Solomon Islands; *P. woodfordi* from Kulambangra, New Georgia, and Guadalcanal in the Solomon Islands; and *P. scapulatus* from northern and eastern Australia and islands in the Torres Strait between the Cape York Peninsula of Queensland and southern New Guinea.

Pteropus gilliardi is easily distinguished from *mahaganus* by its smaller external measurements, smaller skull (see table 1 for comparative measurements), and darker and woollier fur.

From *P. scapulatus* of Australia, *P. gilliardi* differs in its smaller external measurements, smaller cranial and mandibular measurements (except the width of the postorbital constriction), larger molar teeth, smaller and more rounded ears, and completely different coloration.

In comparison with *P. woodfordi*, *P. gilliardi* is larger in all external measurements and all cranial and dental measurements, has more rounded ears, and a thicker, woollier pelage. *Pteropus austini* Lawrence (1945), from the Solomon Islands, was synonymized with *P. woodfordi* by Sanborn and Beecher (1947).

TABLE 2
SIZE OF THE SKULL AND INDEX OF STRENGTH OF THE CHEEK TEETH
(AS PERCENTAGES) IN FOUR SPECIES OF *Pteropus*

	<i>P. gilliardi</i> ^a	<i>P. woodfordi</i> ^b	<i>P. scapulatus</i> ^b	<i>P. mahaganus</i> ^c
Skull, condylobasal length	46.5	41.5 (40.0–42.6)	54.1 (51.3–56.9)	55.7 (52.6–58.7)
Skull, zygomatic width	27.2	27.3 (26.6–28.0)	32.1 (30.2–34.7)	32.2 (29.0–35.4)
Sum of means of skull measurements	73.7	68.8	86.2	87.9
S, skull index number	8.58	8.29	9.28	9.37
Absolute size, as percentage based on <i>P. woodfordi</i>	103	100	112	113
Sum of tooth measurements ^d	26.7	21.0	23.8	27.0 ^e
C, cheek-tooth index number	5.2	4.6	4.9	5.2
I, index of cheek-tooth strength	0.606	0.555	0.528	0.555
Index of cheek-tooth strength, as percentage based on <i>P. gilliardi</i>	100	92	87	92

^a Figures based on a single specimen, the holotype.

^b Figures based on three specimens each of *woodfordi* and *scapulatus*; mean value, range in parentheses.

^c Figures (from Sanborn, 1931) based on five specimens; mean value, range in parentheses.

^d See table 1.

^e Based on measurements (from Sanborn, 1931) of m^2 and m_3 .

RELATIVE STRENGTH OF CHEEK TEETH

The absolute size of the four species of fruit bats now associated in the "*Pteropus scapulatus* group," the members of which have relatively weak cheek teeth, varies widely. As an index of the relative size of the four species, I have used the square root of the sum of the means of two linear measurements, the condylobasal length and the zygomatic width of the skull. On this basis, with *P. woodfordi* as a base of 100 per cent, *P. gilliardi* is slightly larger and *P. scapulatus* and *P. mahaganus* are considerably larger (see table 2). The use of the length of the forearm as a criterion of size would emphasize the disparity in size between *P. gilliardi* and *P. woodfordi*, the former being the larger of the two.

In order to compare the relative size of the cheek teeth of these four species, a simple formula ($I = C/S$) has been used: I represents the index of cheek-tooth strength; C , the cheek-tooth index number, obtained from the square root of the sum of the measurements of length and width of seven cheek teeth (p_4^4 , m_1^1 , m_2^2 , m_3^3); S , the skull index number, obtained from the square root of the sum of the means of the measurements of the condylobasal length and the zygomatic width.

With the use of the I value of the new species, *P. gilliardi*, as a base of 100 per cent, the percentages for the other three species were then calculated. It is seen that *P. gilliardi* has the most strongly developed cheek teeth, for its size, in this small group of weak-toothed species (see table 2).

DISCUSSION

HABITAT

The highly dissected limestone ridges in the heart of the Whiteman Range where the Gilliards collected are covered with mature forest, heavily mossed on account of the persistent cloud cover and high rainfall. Gilliard reported rhododendron (only three species are known from New Britain), scrambling bamboo, and a species of pandanus in this forest. "Mossy forest" has no standing botanically; it is a descriptive term only, not a distinct vegetational type. Mossing of vegetation is a direct response to the presence of moisture-bearing clouds over long periods each year and may occur at lower and higher elevations. Nothing is implied about the composition of the forest, which is poorly known botanically. The color pictures of this forest in Gilliard (1961), at the altitude where Margaret Gilliard successfully mist-netted several species of fruit bats, remind me of the heavily mossed mid-montane oak and *Castanopsis* forests of the Huon Peninsula on mainland New Guinea where S. O. Grierson and I collected in 1964. The two localities are only 190 miles (304 kilometers) apart and are similarly exposed to the southeast trade winds. *Castanopsis* is known to occur east of the Whiteman Range in the Nakanai Mountains, and *Nothofagus*, the southern beech, has also been collected on New Britain (T. Henty, *in litt.*). These dripping mountain forests can be unpleasantly cold and raw for long periods during the year. It may be in response to these prevailing conditions that *Pteropus gilliardi* is dark-colored and heavily clothed with a dense, woolly pelage. *Pteropus temminckii capistratus*, which Margaret Gilliard collected at various altitudes from near sea level to about 3000 feet (925 meters), is also very heavily furred.

FOOD SOURCES AVAILABLE FOR *Pteropus gilliardi*

A botanical collection made in 1966 by D. G. Frodin in the mountains of western New Britain shows that a wide range of potential food trees for flying foxes is present; at least 11 families are represented in this mountain flora (T. Henty, *in litt.*). There are also wild bananas. Pawpaws have possibly spread to at least 4000 feet (as they have on the mainland), coming up in natural and artificial clearings from seeds spread by flying foxes and birds. They certainly occur in this way in the lowland rain forests to 1200 feet. *Eucalyptus deglupta* is reported by P. van Royen (*in litt.*) in the forest at elevations of from 5000 to 6000 feet in New Britain. Van Royen, as he flew over the mountainous interior in 1964 and 1965, noted that this eucalyptus was particularly common in limestone areas. Several species of *Eugenia* (Myrtaceae) are found on New Britain; these species provide not only blossoms but soft fruit as well. Even in tropical Queensland, however, where there are many more species of flowering plants than in the mountains of New Britain, the forests do not offer a stable 12-month supply of blossoms. Although *P. gilliardi* is considerably smaller than *P. scapulatus* and *P. mahaganus*, its dentition is relatively stronger. I suggest that *P. gilliardi* will be found to feed not only on blossoms, but also on relatively thin-skinned soft fruits.

FEEDING HABITS OF OTHER MEMBERS OF THE "*Pteropus scapulatus* GROUP"

In 1948 on the Cape York Peninsula (Queensland) L. J. Brass and I frequently saw *Pteropus scapulatus* feeding in bloodwood trees (*Eucalyptus polycarpa* and *E. dichromophloia*) in open forest. According to Andersen (1912), *P. scapulatus* has many more variations in its cheek teeth than any other species of *Pteropus*. The weak and variable dentition of *P. scapulatus* is probably an evolutionary response to its habit of feeding on the blossoms of eucalyptus and other trees.

Ratcliffe (1931) wrote: ". . . the four Australian species of flying fox [*P. poliocephalus*, *P. gouldi*, *P. conspicillatus*, *P. scapulatus*] do not all evince the same preferences in the matter of food. In comparison with the three larger species, the little Red Fox (*Pt. scapulatus*) is unique in its dentition, which is markedly reduced. The canines are of normal size; but the cheek teeth are exceedingly small and narrow. The weakness of its dentition probably accounts for the rather special feeding habits of this species, for fruit plays a relatively unimportant part in its diet. In Queensland, the little Red Fox is almost exclusively a blossom feeder. It very rarely seems to attack cultivated fruit, with the possible exception of mangoes (and mulberries). . . . Even in the case of such a soft fruit as the mango, I was informed that 'the little Red Fox sucks those fruit which have already

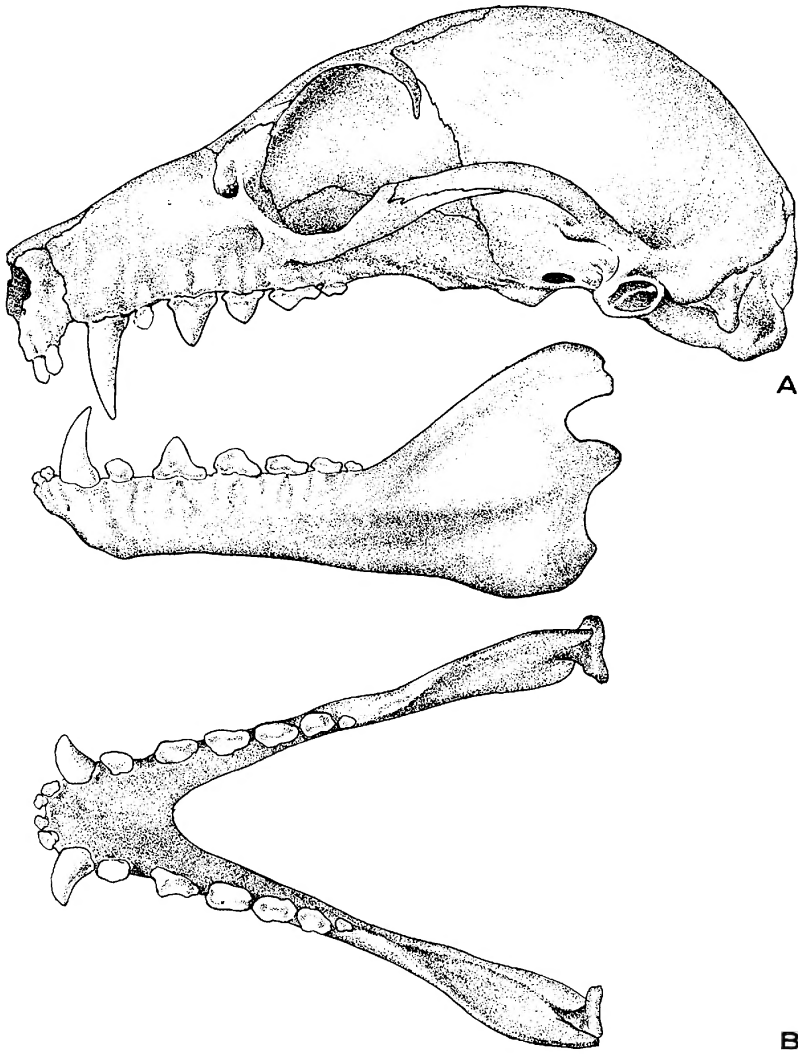


FIG. 2. *Pteropus gilliardi* Van Deusen, new species, young adult male, holotype, A.M.N.H. No. 194292. A. Lateral view of the skull. B. Dorsal view of the mandible. $\times 2$.

been bitten by the large black variety' [*P. gouldi*]." In the coastal districts of New South Wales, however, Ratcliffe found that *P. scapulatus* had readily taken to orchard-grown soft fruit. One comment by Ratcliffe on the mechanics of feeding by *Pteropus* is pertinent to this discussion, "flying foxes do not appear to eat their food in a strict sense, but to crush

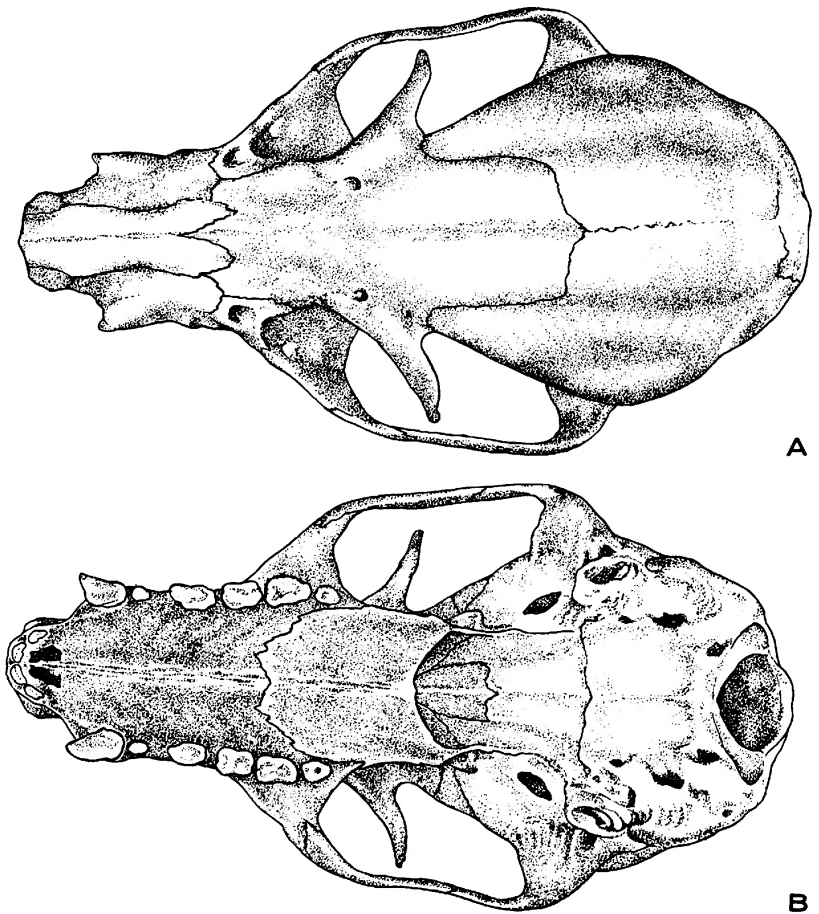


FIG. 3. *Pteropus gilliardi* Van Deusen, new species, cranium of young adult male, holotype, A.M.N.H. No. 194292. A. Dorsal view. B. Ventral view. $\times 2$.

each mouthful to extract the liquid contents, spitting out the hard or fibrous matter; this is very noticeable in the case of mangoes and peaches."

Nelson (1965) has graphed the monthly flowering of the 19 most common plant species in his study area (southeastern Queensland). The blossoms of all these are eaten by flying foxes. One or more species of plant is in flower each month of the year, but blossoming is more pronounced in the period from August to March. The peak is from October to January. There is a direct correlation between good blossom years and the size of the *scapulatus* population in its summer "camps" (where

copulation and conception occur).

Sanborn (1931), evidently quoting the collector F. C. Wonder, noted that both *P. mahaganus* and *P. woodfordi* were shot at night in the Solomon Islands "while feeding on young green coconuts." This observation is surely inaccurate. These bats were probably feeding on the inflorescence associated with the immature coconuts in the crowns of these palm trees (*Cocos nucifera*). Leonard J. Brass (*in litt.*) remarked that the flowers of the coconut palm are sweetish to the taste. The sweetness is in a mass of soft tissue within the base of the flower which consists of a fleshy disk and rudimentary ovary. The pollen-bearing anthers are rather large and are borne on fleshy filaments. In Brass's opinion the coconut flowers might be expected to have substantial food values for a flying fox. An observation by O. L. Austin, Jr., quoted by Lawrence (1945), throws more light on the feeding habits of *P. woodfordi*: "I saw this bat crawling around the new fronds in the center of a coconut tree late in the afternoon . . . [It] seemed to be feeding on the pollen shoots [= anthers]."

Unfortunately no studies on *Pteropus* such as those by Ratcliffe and Nelson have been made in the New Guinea-Solomon Islands area. Many detailed observations on a long-term basis, coupled with a good banding program are needed. These studies should be correlated with botanical observations on the flowering and fruiting seasons of plants of the lowland and mid-montane forests.

LITERATURE CITED

ANDERSEN, KNUD

1912. Catalogue of the Chiroptera in the collection of the British Museum. Second edition. London, British Museum (Natural History), vol. 1, Megachiroptera, ci+854 pp., 79 figs.

DAVIS, JOSEPH A., JR.

1956. A plea for an adequate color standard. Jour. Mammal., vol. 37, pp. 269-271.

GILLIARD, E. THOMAS

1961. Exploring New Britain's land of fire. Natl. Geogr. Mag., vol. 119, pp. 260-292.

HANDLEY, CHARLES O., JR.

1959. A revision of American bats of the genera *Euderma* and *Plecotus*. Proc. U. S. Natl. Mus., vol. 110, pp. 95-246.

LAWRENCE, BARBARA

1945. Three new *Pteropus* from New Caledonia and the Solomons. Proc. New England Zool. Club, vol. 23, pp. 59-69.

NELSON, J. E.

1965. Movement of Australian flying foxes (Pteropodidae: Megachiroptera). Australian Jour. Zool., vol. 13, pp. 53-73.

RATCLIFFE, F. N.

1931. The flying fox (*Pteropus*) in Australia. Council Sci., Indus. Res., Commonwealth of Australia, Melbourne, Bull., no. 53, pp. 1-81, figs. 1-4, 1 map.

RIDGWAY, ROBERT

1912. Color standards and color nomenclature. Washington, iv + 44 pp., 53 pls.

SANBORN, COLIN CAMPBELL

1931. Bats from Polynesia, Melanesia, and Malaysia. Publ. Field Mus. Nat. Hist., zool. ser., vol. 18, pp. 7-29.

SANBORN, COLIN CAMPBELL, AND WILLIAM J. BEECHER

1947. Bats from the Solomon Islands. Jour. Mammal., vol. 28, pp. 387-391.

SANBORN, COLIN CAMPBELL, AND A. J. NICHOLSON

1950. Bats from New Caledonia, the Solomon Islands, and New Hebrides. Fieldiana: Zool., vol. 31, pp. 313-338.

VILLALOBOS-DOMÍNGUEZ, C., AND JULIO VILLALOBOS

1947. Atlas de los colores. Buenos Aires, Librería *El Ateneo* Editorial, xv + 74 pp., 38 pls., 2 tables. [Guaranteed copy No. 0013.]